(No Model.) 3 Sheets—Sheet 1.

L. H. NASH.

OSCILLATING METER.

No. 300,625. Patented June 17, 1884.

Fig. 1.

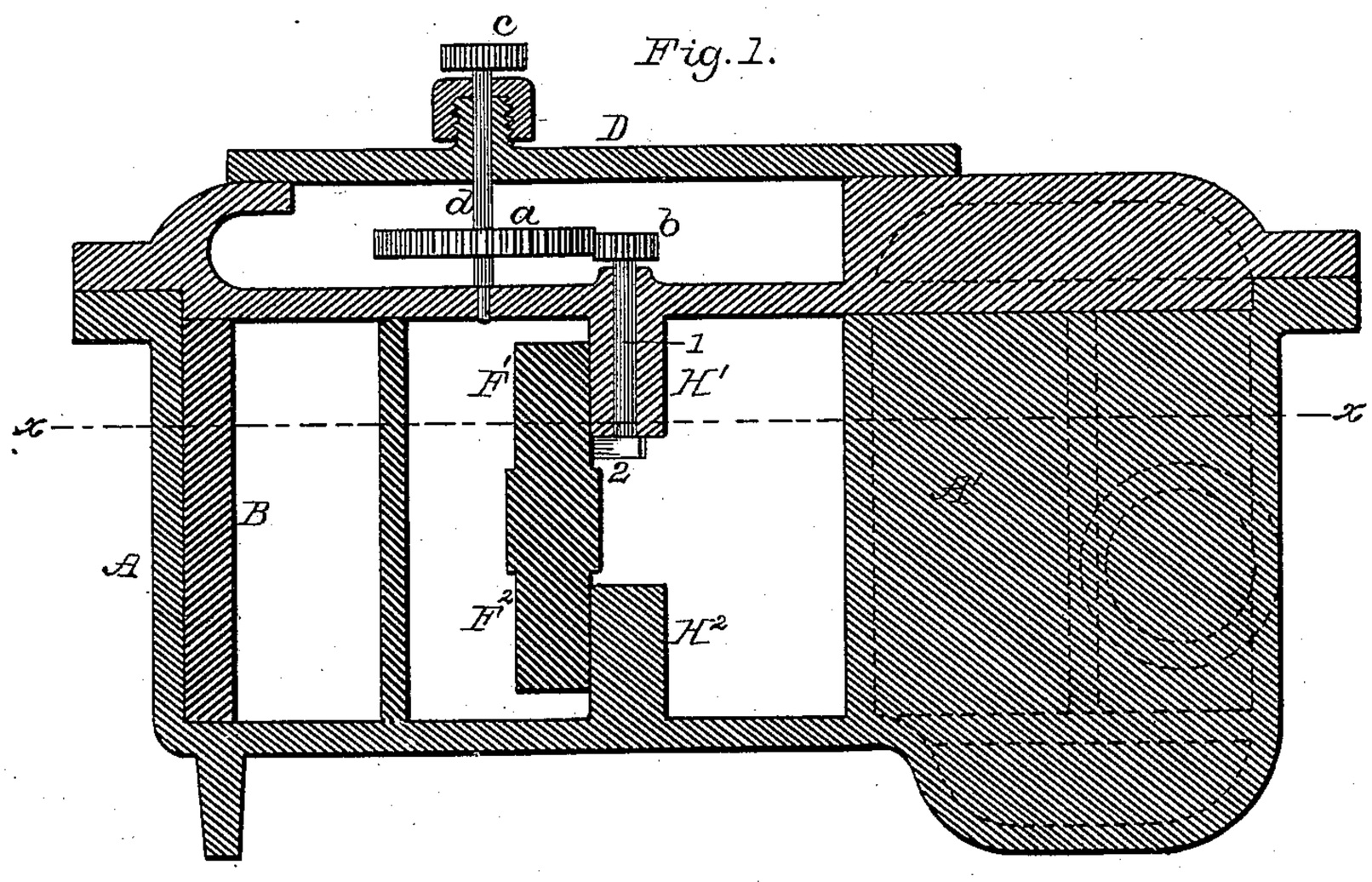
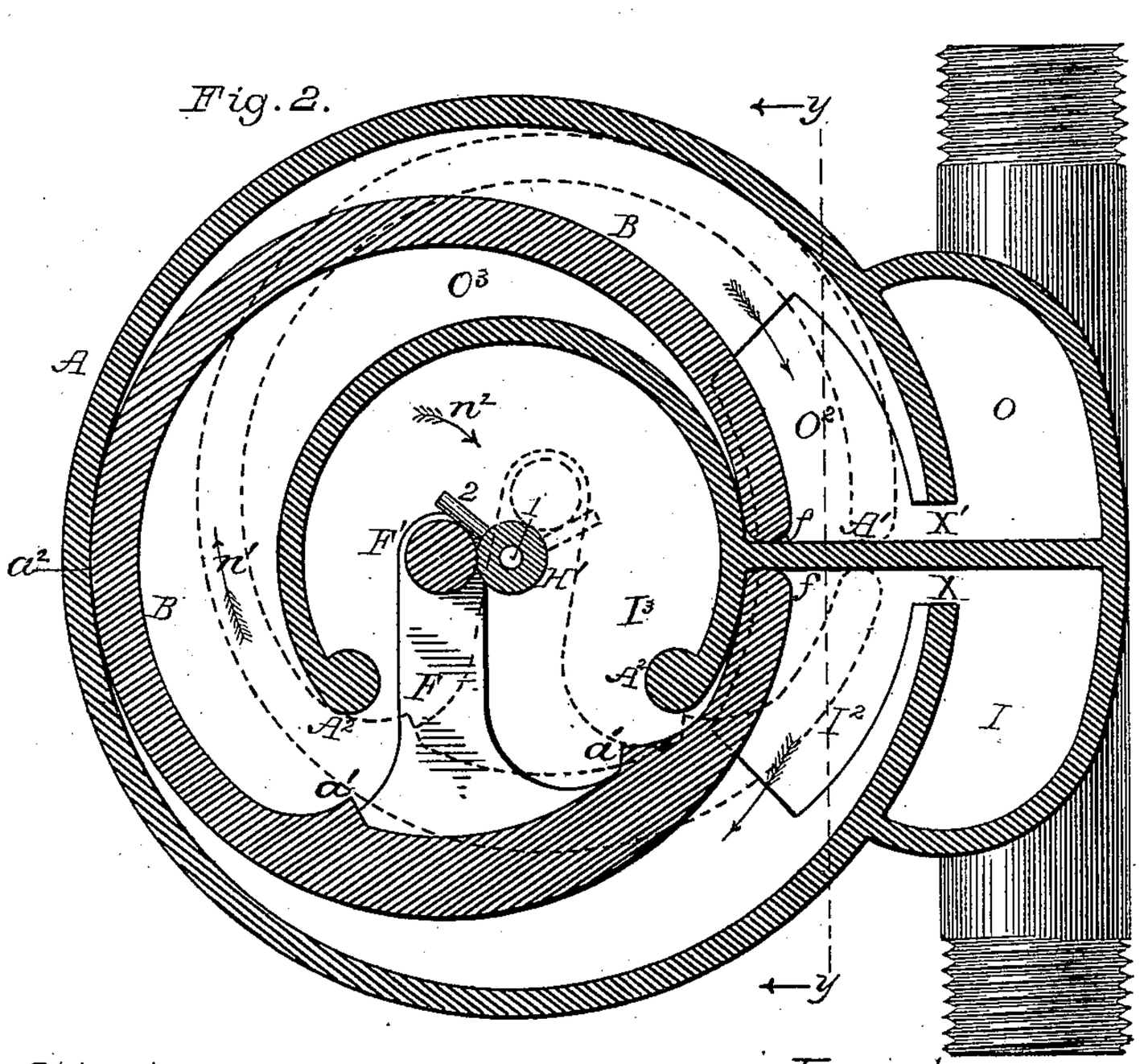


Fig. 2.



Attest:
Howell Barbe
Lettie Norris

Inventor:
Lewis Hallock Nash
by Johnson and Johnson
Attys.

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Fig. 3.

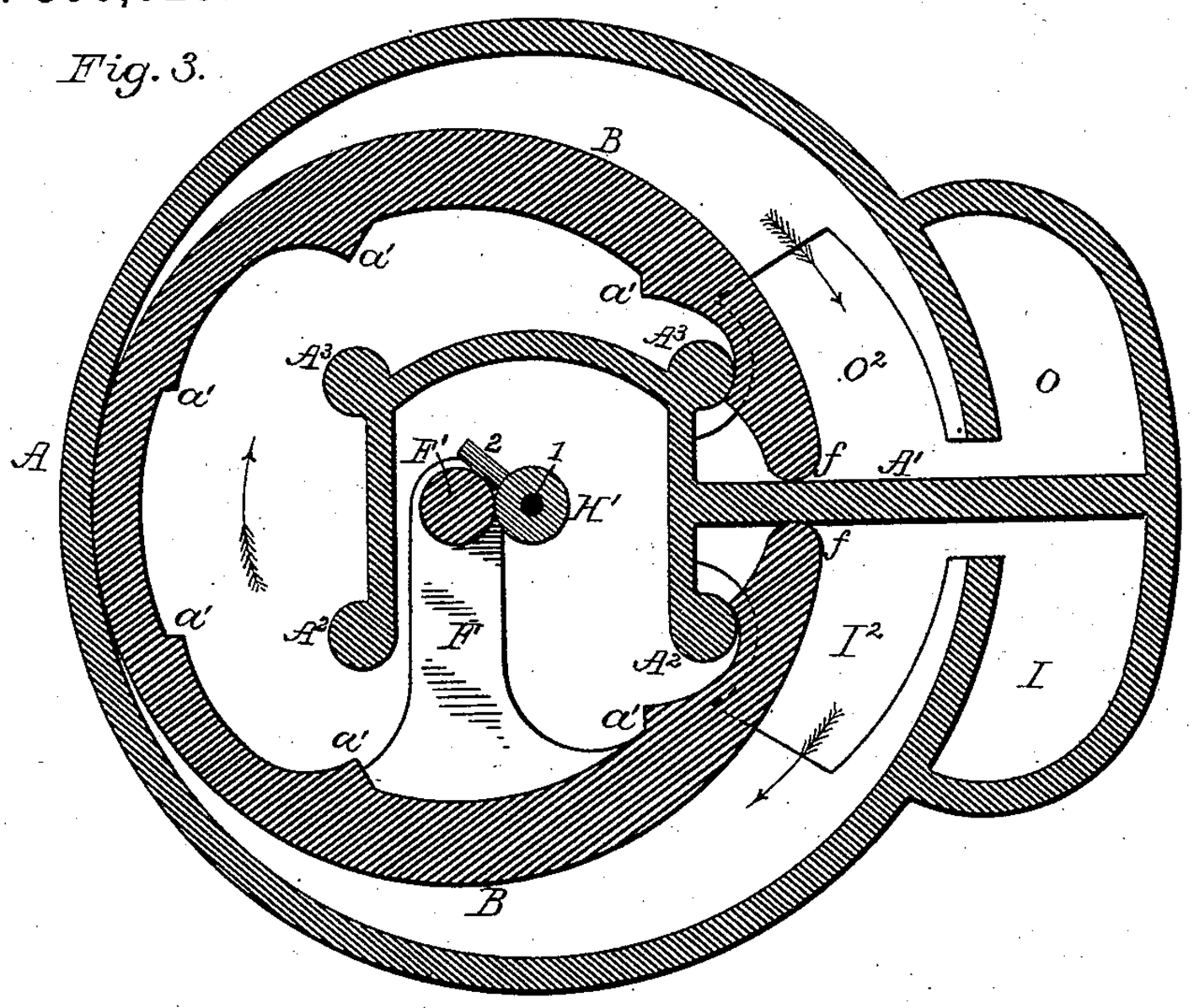
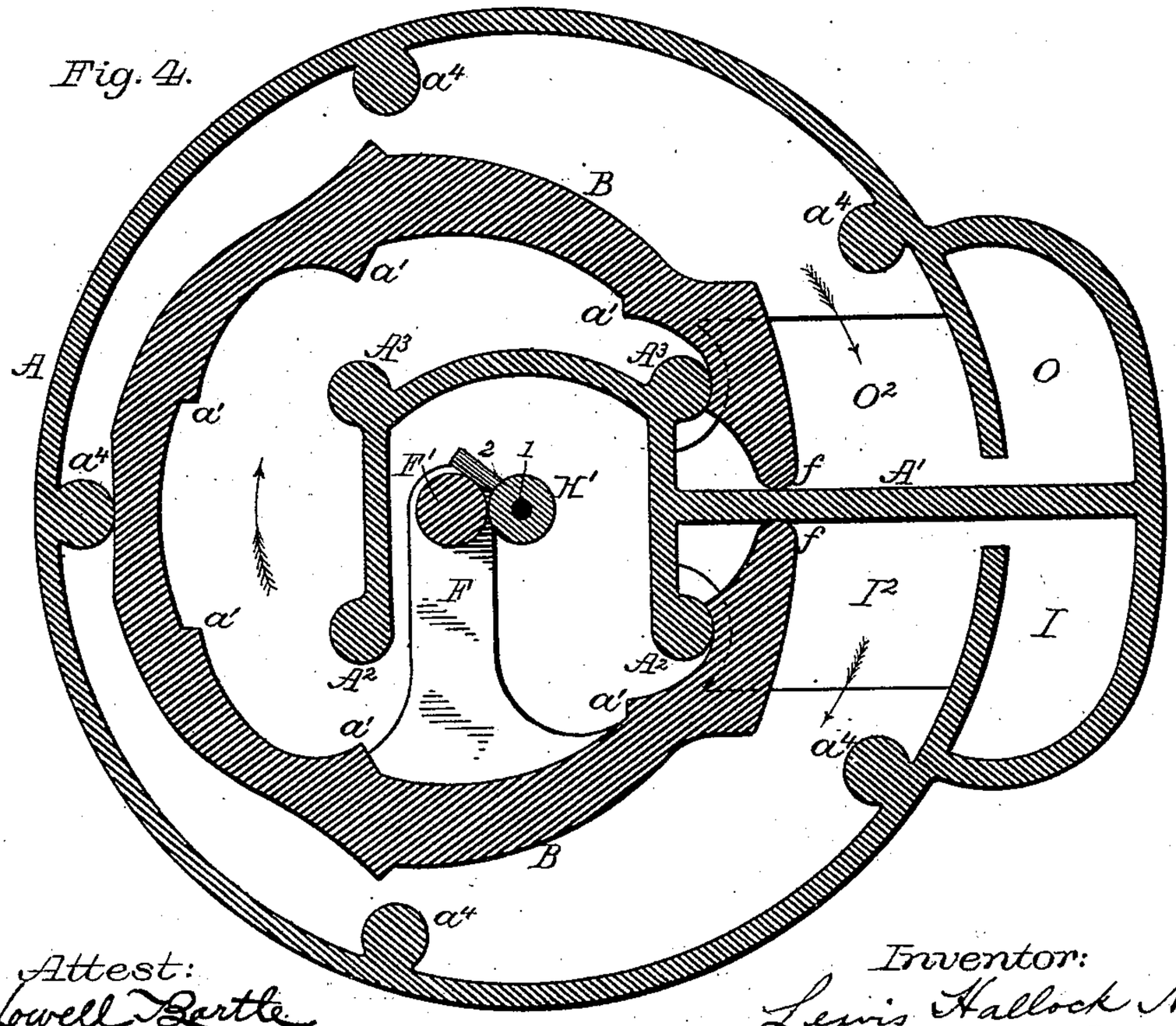


Fig. 4.



Attest:
Howell Bartle
Lettie Morris.

Inventor:
Lewis Hallock Nash
by Johnson & Johnson
Attys

(No Model.) 3 Sheets—Sheet 3.

L. H. NASH.

OSCILLATING METER.

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Fig. 6.

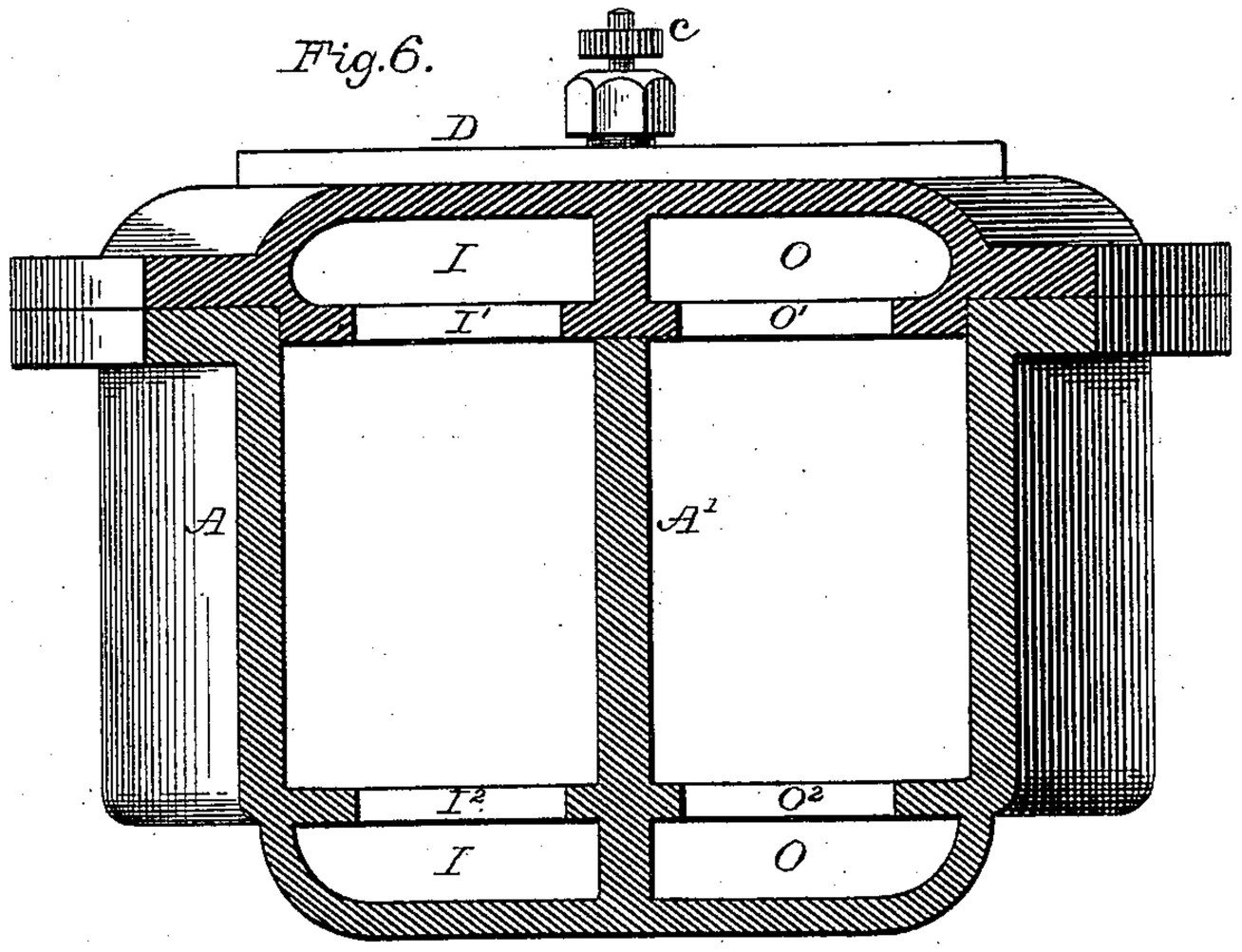
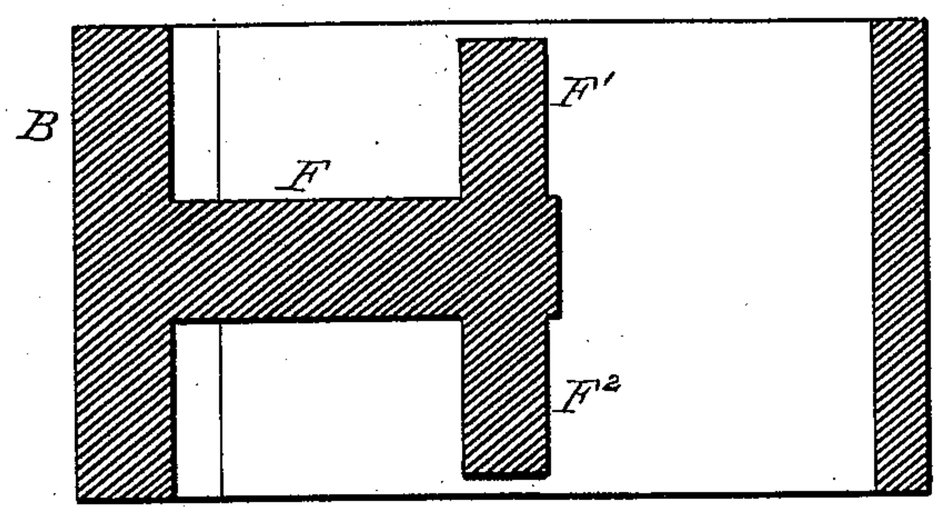


Fig. 5.



Attest:
Howell Bartle
Lutie Norris.

Inventor:
Lewis Hallock Nash
by Johnson & Johnson
Attys.

UNITED STATES PATENT OFFICE.

LEWIS HALLOCK NASH, OF BROOKLYN, ASSIGNOR TO THE NATIONAL METER COMPANY, OF NEW YORK, N. Y.

OSCILLATING METER.

SPECIFICATION forming part of Letters Patent No. 300,625, dated June 17, 1884.

Application filed December 18, 1883. (No model.)

To all whom it may concern:

Be it known that I, LEWIS HALLOCK NASH, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented new and useful Improvements in Rotary Water-Meters, of which the following is a specification.

Steam-engines have been constructed upon the plan of an eccentrically-moving piston adapted to rock upon a radial abutment within an inclosing-case, to divide said case into receiving and discharging spaces, the center of the piston describing a circle around the center of the case. A piston adapted to have such a motion I use in my improved water-meter; and the objects of my improvements are to simplify the construction and perfect the operation of the meter, to effect accuracy of measurement of the water, and to produce a meter in which the eccentrically-moving piston operates without a dead-center, and thus obtain the advantage of a uniform movement. I use an open-ring piston—that is to say, a piston having no transverse division, but having its interior open from end to end—and I combine therewith an abutment of the inclosing-case adapted to extend within the interior of the open piston, from one head of the inclosing-case to the other, to form a joint upon the interior surface of the piston at every point of the motion of the latter, whereby its motion is effected by an interior and exterior pressure, the interior pressure being equalized by reason of the piston having no transverse dividing-plate. The abutment, while extending from one head of the case to the other, extends within the open-ring piston and terminates therein in such form as to make a joint at one or more points with the interior wall of the open piston from one end thereof to the other. The construction by which the joint is formed may be varied from that shown, which consists of an enlargement of the inner end of the abutment, open at one side, extending through the interior of the piston, so as to inclose the center upon which the piston swings, and receiving through its open side a radial arm by which the piston is controlled in its eccentric movements, whereby the central controlling-bearing of the piston is supported within the center of the case without the aid of a transverse dividing-web for the piston. This provision for a center bearing for the piston also gives the advantage of using an abutment extending from head to head of the cylinder. The interior wall of the piston is of such form as to maintain at all positions of its motion a joint upon the enlargement of the abutment, such interior wall being made for this purpose with special reference to the form of the abutment. The division of the interior of an open-ring piston into receiving and discharging chambers by means of an abutment upon which the piston slides forms an important feature of my meter, and it is this construction which allows the piston to be driven by the pressure of the water in all positions of its movement and avoid a dead-center, which advantage has only been obtained in rotary steam-engines by means of dividing the piston by a transverse plate.

Referring to the accompanying drawings, Figure 1 represents a vertical section of a meter embracing my invention; Fig. 2, a horizontal section of the meter on the line *x x* of Fig. 1; Fig. 3, a similar section showing a modification of the abutment; Fig. 4, a similar section showing the case as having certain points of bearing for the piston. Fig. 5 is a vertical section of the piston, and Fig. 6 a vertical section through the inlet and outlet ports and passages on the line *y y* of Fig. 2.

The cylinder or case A has at one side an extension-chamber, forming the inlet-passage I and outlet-passage O, which connect by branch passages with the inlet-ports I′ I² and outlet-ports O′ O² in the cylinder-heads. The case has a radial abutment, A′, extending from head to head of the cylinder and dividing the case into receiving and discharging spaces. The abutment terminates at its inner end in an enlargement of such form as to inclose the guiding-arm of the piston, and for this purpose is open at one side, so as to form joint-forming ends A² A².

The piston B is an open ring, and has an eccentric motion about the center of the case, guided by a slot, *f*, formed longitudinally in its side upon the radial part A′ of the abutment. The interior surface of the piston is provided with one or more projections, *a′ a′*, or is of such construction as to form a joint

with the abutment ends A^2 A^3 at certain times in the movement of the piston, so that the joint will be constant. The piston has on its interior surface an arm or bracket, F, from which project two studs, F′ F^2, arranged in the center of said piston. The case is provided with two studs, H′ H^2, extending from the heads inward, and around which the piston-studs revolve in contact with the case-studs. In one of the case-studs, H′, is arranged a shaft, 1, one end of which is provided with a crank or arm, 2, which has a bearing upon the piston-stud, while the opposite end of the shaft has a pinion, *b*, secured to it, which meshes with a gear-wheel, *a*, on a shaft, *d*, one end of which is journaled in the head of the case, while its other end projects through a stuffing-box of the auxiliary head or plate D, as shown in Fig. 1. Upon the outer end of this shaft is secured a gear-wheel, *c*, which meshes with a wheel on a registering apparatus to indicate the number of revolutions of the piston. The head D forms a chamber which contains the speed-reducing gear-wheels *a* and *b*, so that the latter are inclosed within the case.

In the modification shown in Fig. 4 the interior surface of the case is provided with a series of cylindrical projections, a^4 a^4, and the abutment A′ has an enlargement with three sides, the corners as well as the ends of which are provided with cylindrical bearing-points A^2 A^3. The interior and exterior surfaces of the piston are of such form as to maintain a joint-forming contact upon one or more bearing-points of the inclosing-case and of the abutment at all portions of the movement of the piston. The inlet and outlet ports must be made to open into the interior of the piston, which, being open from end to end, is therefore balanced and the interior pressure obtained.

In the modification shown in Fig. 3 the abutment of the case A is similar to the one shown in Fig. 4; but the case is cylindrical on its interior surface, and the piston has a plain cylindrical exterior surface, while the interior surface thereof is provided with a series of bearing-points, as in Fig. 4. The studs H′ H^2 of the case and the studs F′ F^2 of the piston are the same as those shown in Fig. 1, as is also the gearing to the registering apparatus.

In order to increase the capacity of the inlet and outlet ports, I may form openings X X′ in the side of the cylindrical case on each side of the abutment. These openings X X′ extend from the top to the bottom of the case, and communicate with the interior of the case and with the inlet-passage I on one side of the abutment and with the outlet-passage O on the other side of the abutment.

The operation is as follows: The piston being in the position shown in Fig. 2, the water enters the inlet-passage I X, and through the ports I′ I^2 into the case on one side of the piston and forces it in the direction of the arrow, discharging the water from its opposite side through the outlet-ports O′ O^2 into the passage X′ O. As the piston passes to the position indicated by the dotted lines in Fig. 2, the water enters the interior of the piston B from the ports I′ I^2, and assists in the movement of the piston in the same direction. In this operation the piston divides the case, while the enlargement of the abutment divides the interior of the piston. Therefore, as the piston approaches the position shown by the dotted lines, the water enters and presses upon one side of the interior of the piston by the ports I′ I^2, and leaves the other division of the interior of the piston by the ports O′ O^2. In this movement of the piston it swings upon the abutment by its side guide-bearing, *f*, controlled by the co-operating action of the studs F′ F^2 H′ H^2 in such manner that the piston-studs revolve around the case-studs.

Referring to the operation of the piston in the position shown by full lines in Fig. 2, the water enters through the inlet-ports I′ I^2 X, causing a pressure upon the external surface of the piston from the abutment to the opposite point, a^2, of the case, and, driving the piston in the direction of the arrow *n*′, forces the water out from the other side of the piston through the outlet-ports O′ O^2 X′. As the piston assumes the position shown in dotted lines, the inlet-ports I′ I^2 will open communication with the inside of the piston, so as to cause a pressure of water within the piston from the abutment A′ to the point A^2 of contact of the abutment upon the inner wall of the piston, so that there will now be an internal pressure of water on the piston extending from the abutment A′ to A^2 on the inlet side of the piston. The outlet-ports O′ and O^2 have also now opened communication with the interior of the piston upon the opposite side of the abutment A′, so that the interior of the piston is now divided into a receiving-space, I^3, and a discharging-space, O^3, by the abutment-bearing A^2, and the interior pressure acts in connection with the exterior pressure to move the piston in the direction of the arrow n^2. This interior pressure continues throughout the return-stroke of the piston until it is again returned to its original position. (Shown in full lines.) In this movement of the piston the exterior and interior pressures act in unison with each other to produce the movement of the piston, and in doing so the point of contact a^2 of the exterior of the piston with the wall of the case is continually changing its position, and also the point of contact of the interior of the piston upon the abutment is continually changing in such manner that the combined internal and external pressures always act upon the piston in the direction of its motion.

By reason of the form of the joint-forming end of the abutment the piston-slot *f* need not necessarily form a joint with the radial part A′ of the abutment, since the joint is maintained at all times by the enlarged end of the abutment. The eccentric movement of the

piston causes its studs to travel around the fixed case-stud, and thus revolve the crank 2 and operate the registering apparatus.

I have described the meter as having two inlet and two outlet ports; but it will operate as well with one inlet and one outlet port, which may be either at the top or at the bottom of the case.

I have described the piston as being guided in its movement by the contact of the studs, and the movements of the piston are measured by the co-operating action of the crank-arm 2 with said piston; but it is obvious that the movement of the piston might be controlled by a direct crank-connection with the shaft 1 without the studs F′ or F², in which case the joint-contact of the piston with the case would be maintained in the same manner, and the registration effected through the register-gears in the same manner.

It is obvious that by dispensing with the registering mechanism and applying power to the piston by means of a crank the machine may be used as a pump; or, if the pressure of the water upon the piston be transmitted through a crank and shaft through the case, the device can be used as a motor.

I know that an engine having a transverse divided piston adapted to rock upon a dividing-abutment within an inclosing-case, and operating without a dead-center, is old; and I know that an engine having a piston open from end to end operating with a dead-center is also old; but my invention consists in using a piston open from end to end, and adapting said piston to operate without a dead-center, which is effected by such a conformation of the interior of the open piston and of the inner end of the abutment as will effect a dividing-joint within the piston at all points of s movement within the case, whereby I obtain the important advantage of assisting the movements of the piston by an interior pressure co-operating with the exterior pressure.

I claim—

1. The combination, in a water-meter, of an eccentrically-moving piston open from end to end, having a longitudinal slot, *f*, at its side, and an inclosing-case having a radial abutment extending from one head of the case to the other, having an enlarged end and forming a joint within the piston, with a crank and shaft having a bearing within the case, adapted to connect the said open piston with a train of speed-reducing gearing, substantially as described, for the purpose specified.

2. The combination of an eccentrically-moving piston having one or more central studs and a side longitudinal slot, with an inclosing-case having a dividing-abutment upon which the piston slides, adapted to form a joint within it, suitable inlet and outlet ports, and one or more fixed central studs adapted to co-operate with the central studs of the piston to control the eccentric movements of the same, substantially as described, for the purpose specified.

3. The combination, in a water-meter, of an eccentrically-moving piston having one or more central studs and a side longitudinal slot, with an inclosing-case having a dividing-abutment upon which the piston slides, adapted to form a joint within it, suitable inlet and outlet ports, and one or more fixed central studs adapted to co-operate with the central studs of the piston to control the movements of the same, and suitable means for registering the said movements of the piston operated by it, substantially as described.

4. The combination of an eccentrically-moving open-ring piston having a longitudinal slot, *f*, in its side, with an inclosing-case having an abutment extending from one head of the case to the other, adapted to divide the case and to make a joint upon the inner wall of the open piston, whereby the inclosing-case and the interior of the piston are divided into receiving and discharging spaces, communicating with suitable inlet and outlet ports of the case, substantially as described.

5. The combination of an inclosing case or cylinder having a radial abutment extending from head to head of the cylinder, and terminating at its inner end in an enlargement open at one side, and having suitable bearing-points, with an eccentrically-moving open-ring piston having an interior conformation adapted to form a joint with said abutment, and a longitudinal slot in its side forming a guide upon said abutment, and suitable means connected with the case for controlling the motion of the piston, substantially as described.

6. The combination of an inclosing-case having interior wall bearing-points and a radial abutment extending around the center of said case from head to head, terminating in suitable bearing-points, with an eccentrically-moving open-ring piston having a longitudinal slot in its side and bearing-points upon its exterior and interior wall, adapted to form a joint to divide the said case and the interior of the open piston into receiving and discharging spaces, which communicate with suitable inlet and outlet ports in the case, substantially as described.

7. The combination, in a water-meter, of an inclosing case or cylinder having a radial abutment extending around the center of said case from head to head, and forming around said center an enlargement open at one side, having end or corner bearing-points, with an eccentrically-moving piston open from end to end, having bearing-points adapted to co-operate with those of the abutment, a longitudinal slot, *f*, on one side, forming a guide upon said abutment, and a radial arm, F, extending between the arms or bearing-points of said abutment, provided with central studs co-operating with fixed central studs of the case, substantially as described, for the purpose specified.

8. The combination, in a water-meter, of an inclosing-case having a radial abutment extending around the center of the case from

head to head, and fixed central studs, H′ H², with an eccentrically-moving open-ring piston having a longitudinal slot, *f*, in its side, central studs, F′ F², the shaft 2, having a bearing in said case-stud H′, and a crank-arm, 1, arranged to bear upon the piston-stud F′, and suitable registering mechanism connected with said shaft, substantially as described.

9. The combination, with an inclosing-case having suitable inlet and outlet ports and a radial abutment terminating in an enlarged end centrally in said case, of an open-ring piston having a guide-bearing arm, and means for connecting said arm, with means for controlling the movements of the piston to continually make a joint-contact with the said abutment to divide the piston into receiving and discharging spaces, for the purpose specified.

10. The combination, in a water-meter, of an eccentrically-moving piston open from end to end, with means, substantially such as described, for dividing its interior into receiving and discharging spaces, and means for controlling its movements to effect such division, substantially as described, for the purpose specified.

11. The combination, with an inclosing-case having suitable inlet and outlet ports and a radial abutment terminating in an enlarged hollow end in the central part of said case, of an open-ring piston provided with an arm extending into said hollow end, by means of which, co-operating with means carried by the case, the motion of the piston is controlled in said case, for the purpose specified.

12. The case A, having inlet and outlet head-ports divided by an abutment, as described, and the ports X X′ in the vertical walls of said case on each side of said abutment, combined with a ring-piston having a side slot adapted to form a joint-bearing upon said abutment, controlled in its eccentric movements to divide said case, the said vertical wall-ports allowing a free inflow and outflow of the water into and from said case the full height of the piston.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

LEWIS HALLOCK NASH.

Witnesses:
A. E. H. JOHNSON,
J. W. HAMILTON JOHNSON.